

**ASSESSMENT OF IMPACT OF GENETICALLY
ENGINEERED (GE)
MUSTARD (*Brassica juncea* L.) ON HONEY BEES**



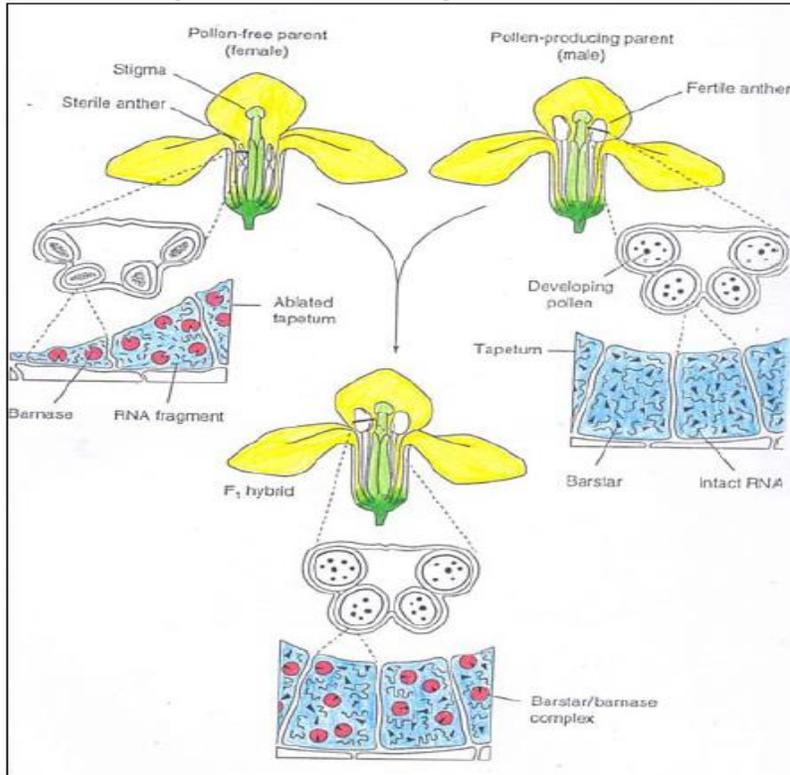
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Technology used to control pollination in GE mustard to produce hybrid seed (DMH-11)



- ❖ Based on the biosafety data generated over a period of 13 years, regulators prepared an Assessment of Food and Environment Safety (AFES) document and invited public comments by placing it in the MoEF&CC website.
- ❖ Three possible risk scenarios were considered to assess effect of GE mustard on honey bees.

One of the public concern was whether planting of GE mustard would harm honey bee population or affect honey

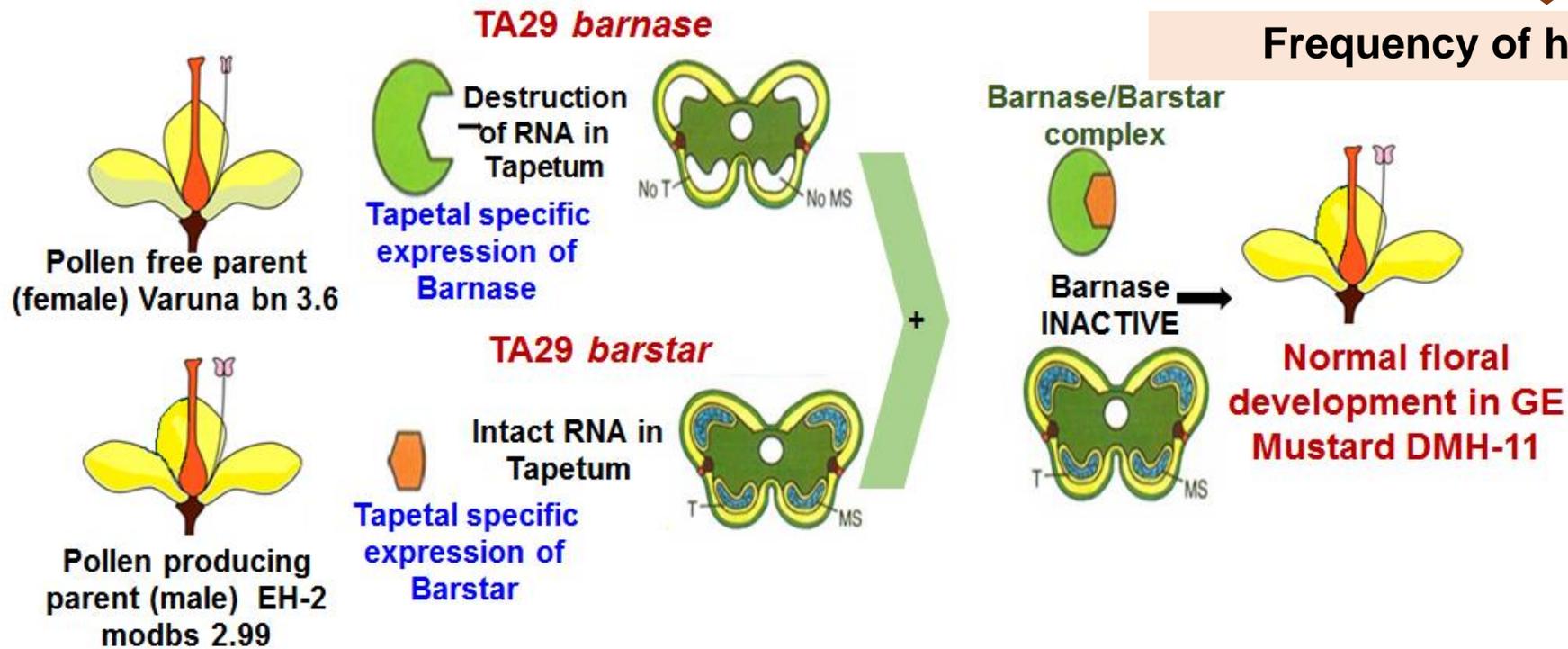
Components of technology

Genes	Promoters	Purpose
<i>barnase</i>	(Tapetum specific)	To make pollen unviable by degrading RNA
<i>barstar</i>	(Tapetum specific)	To inactivate Barnase by binding selectively
<i>bar</i>	(Constitutive)	To select male sterile female parent

RISK Hypothesis 1:

The expressed transgenes will:

- Effect floral morphology
- Effect nectarine development
- Effect the frequency of honey bee visits



Transgene cause unintended effect on the floral development



Highly unlikely

Nectarine development in GE mustard DMH-11 effected



Highly unlikely

Frequency of honey bee visits affected

Highly unlikely

Risk assessment on effect of transgenes on floral morphology is found to be negligible/nil

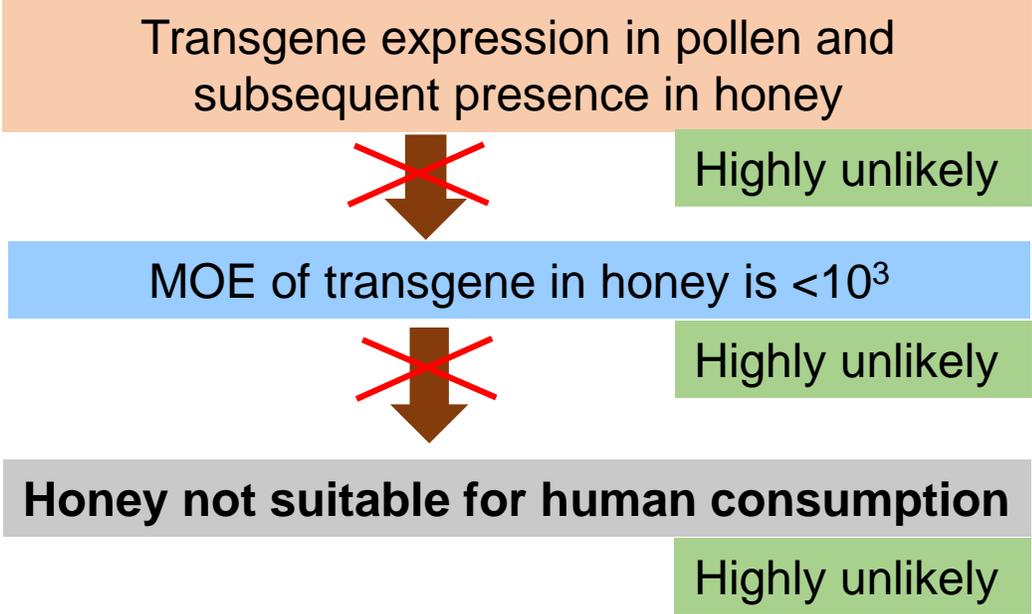
RISK Hypothesis 2:

“Presence of transgene encoded proteins in pollen will make honey unsuitable for human consumption”

Estimated Daily Intake (EDI)
 5.62e-10 Barnase protein/kg bw/d (mean user) & 1.40e-9 Barnase protein/kg bw/d (90% user)

Rodent acute oral toxicity study:
 * No adverse effects observed at highest dose tested = 1000 mg Barnase protein/kg body weight

Margin of Exposure (MOE)
 The MOE for consumers (90%) of **RAW** honey is at least $1000 / 1.40e-9 = 7.1 \times 10^{11}$!
 as compared to MOE of Cry protein of 10^8
Higher the MOE, the lower the health concern; MOE >10³ low concern

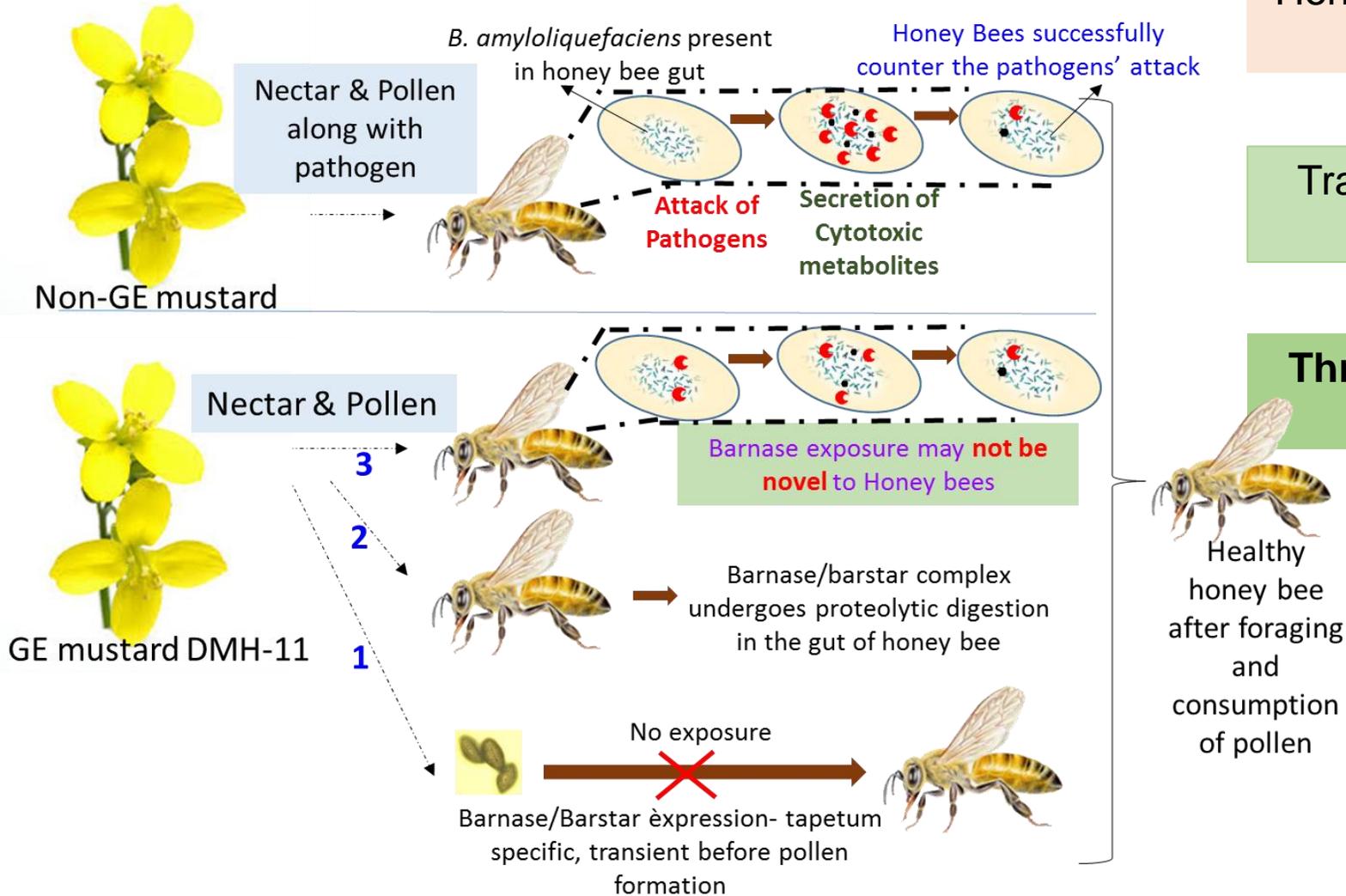


- ❖ Barnase expression is specific to tapetum and transient during pollen production
- ❖ >20 years of history of safe use of Barnase in rapeseed (*B. napus*), a sister crop of Indian oilseed mustard

Risk assessment on potential toxicity of honey to human is found to be negligible/nil.

RISK Hypothesis 3:

Nectar/Pollen containing transgene toxic to honey bees



Honey bee forages for nectar and pollen of GE Mustard
Highly likely

Transgene present in pollen is toxic to honey bees
Highly unlikely

Threat on honey bee population due to exposure of transgene
Highly unlikely

Risk assessment on toxic effect of transgenes on honey bee population was found to be negligible/nil.

Conclusion

- ❖ The risk due to the expression of transgenes in GE mustard DMH-11 on honey bee population has been assessed as **Negligible**
- ❖ The risk due to the expression of transgene on honey has been assessed as **Negligible**
- ❖ Based on risk assessment it was concluded that GE mustard DMH-11 will not pose any risk to honey population as well as honey.